Mapping the Emerging Field of Service Science: Insights from a Citation Network and Cocitation Network Analysis

Completed Research Paper

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Abstract

The purpose of this study is to comprehensively map the recent additions to the body of knowledge in the service science discipline. Previous literature analyses insufficiently account for these developments or refrain from applying tool-based bibliographic analysis techniques. Following the introduction of the software tool CiteBridge, a citation network and a cocitation network are constructed based on 3,783 articles and 6,775 citations. Subsequently, both networks are analyzed (a) to map the scope and structure of the discipline, (b) to identify the most authoritative papers and literature review papers, (c) to discover clusters of research in the discipline, and (d) to explore if the service dominant logic of marketing has evolved into an overarching philosophical foundation for service research. The findings are intended to provide researchers with a sound orientation about the recent developments in the field and to further shape the evolution of service science as a research discipline.

Keywords: Service science, citation analysis, cocitation analysis, service-dominant logic

Background

Theories and artifacts related to service are reflected in the emerging academic discipline of Service Science (Chesbrough and Spohrer 2006) and in its design research oriented normative (Spohrer et al. 2009) part Service Science, Management and Engineering (SSME). Research in SSME is focused on the creation of service in service systems. A service is a provider-client interaction that creates and captures value. Its unique characteristic is that both parties participate in the transaction and both capture value (Katzan 2008). The service system is conceptualized as „a configuration of people, technologies, and other resources that interact with other service systems to create mutual value" (Maglio et al. 2009) and is considered as the basic abstraction in SSME. It constitutes the organizational frame in which the creation of value is performed. The IS discipline is one of the central disciplines engaged with research in SSME (Bardhan et al. 2010).

Recently, the field of SSME has been revitalized with literature from three main directions. First, continuing the evolution of the traditional service marketing literature stream, the Service-Dominant Logic of Marketing (S-D Logic) (Vargo and Lusch 2004; 2007a; Vargo and Lusch 2008) has been prominently proposed as a new paradigm to view the creation of value in general. With the proliferation of service research and in the light of its paradigmatic status, S-D Logic has been widely recognized in various special issues of academic top journals (amongst others, in the Journal of the Academy of Marketing Science, JMIS, MIS Quarterly, JSIS) and on leading IS conferences (such as ICIS, ECIS, HICSS, AMCIS). It has, therefore, quickly assumed a central position in the recent service literature. Second, SSME as a research discipline in its own right has emerged under the patronage of leading edge software companies such as IBM, adding innovative IS architecture paradigms such as service-oriented computing and cloud computing to the traditional portfolio of topics investigated in service research. Third, the transition from products to services in business markets (Jacob and Ulaga 2008) under the headword of servitization (Vandermerwe and Rada 1988) has motivated many manufacturing companies to market their products as integrated solutions (Backhaus et al. 2010) as well as to integrate their business processes with external stakeholders in value networks (Becker et al. 2011).

These developments have boosted as well as greatly influenced the course of the literature in SSME. With the papers published in some of its top research outlets, the IS discipline itself has joined into the SSME community, which has long been dominated by service marketing and service management scholars. Recent literature reviews (Bardhan et al. 2010; Edvardsson et al. 2005) have revealed that SSME now can be considered as a multi-disciplinary research field that brings together scholars from multiple disciplines to study phenomena of the service economy from various angles.

In the light of the diversity of the discipline and the increasing pace of its evolution, thoroughly mapping the recent body of knowledge of service science is an essential step to provide researchers and practitioners with orientation of how the literature has developed in the recent years as well as to identify some current properties and future directions of SSME as a research field in its own right.

Previous attempts to map the authoritative literature in the area of service science focused on descriptive as well as on bibliographic analysis techniques. In a seminal article general services marketing literature containing 1,127 sources as of November 1992 is analyzed to identify the evolution of the services marketing discipline (Fisk et al. 1993). The articles under analysis were compiled by a direct search in major marketing journals. From their analysis, the authors identify three stages of the evolution of the service marketing discipline, dating back to 1953, and envision directions for future research. In a literature review performed in the service research discipline itself (Edvardsson et al. 2005), the authors analyze service literature through a customer lens by searching four search terms related to the concept of service (i.e., service definition; service concept; service notion; definition of services) and eight search terms to identify service characteristics (i.e., service characteristics; service features; service description; character of services; service differences; nature of services; service dimensions; features of services) in several literature databases. From a set of 228 hits related to service definitions, they investigate 34 articles in an in-depth fashion. From a set of 335 hits for service characteristics they investigate 57 articles. In their analysis they indentify three core service dimensions: activities, interactions, and solutions to customer problems. With regards to service characteristics, the authors start with the traditional IHIP criteria (Zeithaml et al. 1985) and then critically assess these notions themselves and also by conducting interviews with leading experts in service research. The review by Bardhan et al. (2010)

identifies various core research streams in the – by now – multi-disciplinary service science discipline based on a literature review that is guided by a theoretical framework. The framework contains four key stakeholder roles (i.e., producer stakeholders, consumer stakeholders, intermediary stakeholders, monitor stakeholders). Consecutively, the perspectives of different disciplines on service science are discussed with illustrative examples. Although these literature reviews have their merits in providing a sound overview on sub-streams of the service science literature, they fail to comprehensively analyze the service science body of knowledge as a whole. For instance, the reliance on keyword searches might limit the results by *a priori* defining the core phenomena to be investigated while neglecting other works that have been contributed to the discipline in the recent boost of literature.

In order to comprehensively assess the properties of the current body of knowledge in service science, the purpose of this paper is framed by the following research objectives:

(RQ1) To map the recent research stream (published between January 2004 and March 2011) in the service science field in order to identify the scope and the structure of the discipline.

(RQ2) To identify the most authoritative research papers (i.e., authorities) and the most essential literature review papers (i.e., hubs) in terms of their position in the citation network.

(RQ3) To discover clusters of research that designate the most comprehensively researched topics in the recent service science literature.

(RQ4) To explore into which areas of service science S-D Logic has diffused to assess if it has evolved into a unifying philosophical foundation for the service science discipline as a whole.

These objectives are reached by mapping the additions that have been made to the body of knowledge on service science in the recent years in two networks. First, the influential first S-D Logic paper (Vargo and Lusch 2004) is taken as the starting point for conducting a citation network analysis on n=3,783 papers (vertices) that are connected with each other with m=6,775 citations (edges). Based on this graph, metrics are computed to assess the deep structure (RQ1) as well as the most authoritative papers and literature review papers (RQ2) in the citation network. Second, a cocitation analysis is performed to identify clusters of research that form the inner core of the service science discipline (RQ3). In addition, from analyzing both networks, conclusions are drawn on the role of S-D Logic for shaping SSME research (RQ4).

The remainder of the paper is structured as follows. In Section 2, the approach taken to build up the citation and cocitation networks is outlined. Based on authoritative literature, citation analysis and cocitation analysis are identified as appropriate bibliometric analysis techniques to answer the abovementioned research questions as well as to justify the software tool-based approach that was taken to compile the citation data in the first place. In particular, some properties of the CiteBridge software tool that was implemented to gather the raw publication data are outlined. In Section 3, the results of analyzing the citation network and cocitation network with a selection of network algorithms are presented. From these analyses, conclusions are drawn to answer the four identified research questions. In Section 4, the theoretical contributions of the results and their limitations are discussed. In Section 5, some prospects to further assess the properties of the service science field are suggested.

Methodology

Preparation

Webster and Watson (2002) identify two types of literature reviews. First, for mature topics for which an accumulated body of knowledge has been established researchers can develop a conceptual model to synthesize and extend the literature. Second, researchers can tackle an emerging issue – such as service science – to identify fresh theoretical foundations and propose a path for advancing the field. Raghuram, et al. (2010) discuss three methodologies to map literature in a field. First, a meta-analysis is designed to statistically summarize the relationships found to be significant between variables across multiple studies and to identify an overall estimate of the coefficients (Gajendran and Harrison 2007). Thus, a meta-analysis brings together results from several studies to create overarching results on a quantitative level. Second, a descriptive literature review can also include qualitative data such as case studies or theoretical articles. The advantages of this approach lie in the richer insights to be gained, albeit it might be difficult to demonstrate the unambiguousness of the insights generated. Third, a bibliometric analysis can be

carried out with software tools to comprehensively search articles in various databases. Citation analysis is a bibliometric approach to identify underlying patterns of relationships between articles based on the reference they cite (Osareh 1996; Raghuram et al. 2010). Another major advantage of this approach is the inclusion of articles from different disciplines.

A citation network is a directed acyclic graph (DAG) since published papers cannot cite papers that are published later on. In the analysis, each paper identified is represented as one vertex. Each citation identified is represented by one directed edge from paper A to paper B if A cites B. There are many reasons why authors cite other papers, such as "to point out information that may be useful to the reader, to give credit for prior work, to indicate influences on current work, or to disagree with the content of a paper" (Newman 2010, p. 67-68). While establishing a categorization of reasons of why a paper gets cited is potentially problematic (MacRoberts and MacRoberts 1989) the number of self-citations and negative citations are usually quite limited (Garfield 1979). Therefore, citations have been found to indicate some kind of influence a cited paper has had on the citing paper (Cole and Cole 1972), leading to the assumption that both papers are indeed related to the same subject matter (Newman 2010). To put it another way, citation analysis is built "on the assumption that bibliographic citations are an acceptable surrogate for the actual influence of various information sources on a research project" (Culnan 1986, p.158).

Several approaches towards mapping an academic field with citation analysis can be found in the literature. Timonen and Paloheimo use a keyword search approach to identify papers related to *knowledge work* and construct a citation network from the references of the papers to map this field (Timonen and Paloheimo 2008). Grover et al. identify the evolution and state of the *IS discipline* within its reference disciplines by conducting a citation analysis of inbound and outbound citations of a selection of 1,406 IS papers (Grover et al. 2006). Raghuram et al. (2010) trace the evolution of research on *virtual work* by analyzing a cocitation network that they build up from the citations of 490 articles that they compiled based on conducting a keyword search. Others strive to contribute a baseline on *computer science* research by setting up and analyzing a citation database based on keyword-list-based autonomous citation indexing on the web as well as by citation analysis in ISI Web of Knowledge (Goodrum 2001). Moreover, Culnan (1986) analyzes the intellectual development of *management information systems* (MIS) as a research field by means of a cocitation analysis. Since MIS was an emerging research topic itself at that time, this study contributes insights into the sub-fields that constituted the young discipline embedded into a set of reference disciplines.

The approach of analyzing two networks based on the articles citing a predefined paper that is taken in this paper is a special form of bibliometric analysis. First, a citation network is built up to identify the scope and structure of the recent research stream in SSME. This is done by identifying all papers that cite a *root paper* along a maximum distance of *five* edges. As this root paper, the initial S-D Logic paper by Vargo and Lusch (2004) was selected for various reasons. First, S-D Logic has received considerable attention in various sub-communities of SSME due to its quite paradigmatic focus on the creation of value as such. Second, it was one of the papers to leverage the recent increase of interest in SSME research and, therefore, can be considered as one of the milestones of the recent literature. Third, the paper stands in the tradition of the roots of service science, which lie in service marketing, such that it was soon accepted as a successor of other influential papers. This view is supported – amongst others – by the 437 citations made to the paper that are documented in ISI Web of Knowledge as of April 2011. The search was limited to a distance of five edges from the root paper, since the number of discovered papers increases exponentially with the distance from the root paper. Therefore, any additional edge would lead to a significant increase in queries to be made to ISI Web of Knowledge as well as to identifying many papers that have increasingly less relations with the core stream of research.

Properties of S-D Logic as the root element of the analyzed stream of literature

S-D Logic is proposed as a potential philosophical foundation of service science (Vargo et al. 2010; Vargo and Lusch 2004). It is built on ten foundational premises that have evolved over time (Table 1). According to S-D Logic, the basic unit of exchange in service systems is *service*, i.e. the application of specialized competences, through deeds, processes, and performances for the benefit of another entity or the entity itself. The singular term *service* is used to underline that all value creation is based on the application of operant resources (i.e., the resources able to act on other resources). Customers, employees, and other

stakeholders, as well as their knowledge and core competencies are examples for operant resources (Levy 2006; Shugan 2004; Vargo et al. 2010). All value is perceived to be co-created in a mutually reciprocal manner by suppliers and customers.

Contrasting S-D Logic, Goods-Dominant (G-D) Logic is argued to be nested into the S-D Logic world view. G-D Logic is argued to be focused on value creation as an exchange of units of outputs (i.e., physical goods and services) (Vargo et al. 2010), as well as on a divide between consumers and producers. It, therefore, would represent a more traditional view on the creation of value that is based on "production and value-added activities such as distribution and sales" (Vargo et al. 2010, p. 137) and is focused on value-in-exchange rather than on value-in-use.

Table 1. Overview of the foundational premises posited by S-D Logic (Vargo et al. 2010).

#	Found. Premises	Rationale
1	Service is the fundamental basis of exchange	"Service" is the application of operant resources and forms the basis for all economic exchange. In the marketplace, service is exchanged for service. Hence, the focus of value-in-exchange (exchange of physical goods) evolves into a focus on value-in-use.
2	Indirect exchange masks the fundamental basis of exchange	As economies evolved, the one-to-one exchange of skills and knowledge was substituted by creating physical objects. Due to isolation from the influence of customers, this approach promised increased efficiency. Also, organizations specialized on core competencies, thereby further masking the basic unit of exchange. Accordingly, money, physical goods, and organizations are vehicles for exchanging specialized knowledge and skills.
3	Goods are distribution mechanisms for service provision	Physical goods are a means of transferring knowledge and skills, which are imbued with encapsulated knowledge. Consequently, just like activities render services, so do physical objects (Gummeson 1995). Customers are seldom interested in a physical good as such, but rather in the service that a physical good can render.
4	Operant resources are the fundamental source of competitive advantage	Competitive advantage can only be sustained if the resources that lead to competitive advantage are not readily imitable. Therefore, operant resources (e.g., knowledge) are the prime source of sustainable competitive advantage. Exchanging information is at the core of relational processes for value creation.
5	All economies are service economies	Service is and always has been the focus in economies, as the common denominator of all value creation is the refinement and exchange of operant resources. The distinction of agriculture, manufacturing, and services made in the traditional economic classification system emerged due to macro specializations of knowledge and skills.
6	The customer is always a co-creator of value	If the super goal of a business is customer responsiveness, isolating manufacturing activities in the technical core of companies comes at the expense of inadequately satisfying customer needs. In relational processes the customer becomes an operant resource (i.e. an asset) rather than an operand resource that a company acts on. All value creation is interactional.
7	The enterprise cannot deliver value, but only offer value propositions	As the value of a service is determined by the customer, service providers can only make value propositions that are fulfilled in relational processes with the customer. Thereby, the value potential of physical goods and services is translated into value-in-use by a customer.
8	A service-centered view is inherently customer orientated and relational	Since value is always co-created with a customer, services require relational processes with customers that extend beyond the transaction.
9	All economic and social actors are resource integrators	The organization exists to serve society and themselves through the integration and application of resources. In addition, the context of value creation is argued to take place in networks of networks.
10	Value is always uniquely and phenomenological determined by the beneficiary	Value is idiosyncratic, experiential, contextual, and meaning laden. Therefore, value can only be determined by the beneficiary, but not by the supplier.

Despite S-D Logic has been found to have many merits in providing a fundamental reference point in SSME, its foundational premises have been subject to critique and are still evolving in a type of open-source evolution (Vargo and Lusch 2007a). Major points of criticism comprise the generic character of S-

D Logic that would take insufficient account of the realities in organizations. These might be shaped more significantly by disciplines such as Accounting, IS or Operations Management (Day et al. 2004). Furthermore, the rather evolutionary than groundbreaking (Achrol and Kotler 2006) or even trivial (Sampson and Froehle 2006) character of S-D Logic, and its abstraction from business processes on an operational level of management (Achrol and Kotler 2006) have been criticized. The distinction of operant resources from operand resources might be ontologically misleading, as the question whether a resource is operant or operand depends on the context in which the resource is utilized (Katzan 2008). Also, treating physical goods as service would be a too service-focused perspective (Brodie et al. 2006) which would perpetuate the dichotomy of physical goods and services instead of providing an integrated approach. This critique has been dealt with by the authors, resulting in adaptations and clarifications of the original foundational premises (Vargo and Lusch 2006; Vargo et al. 2010).

Data Source

All articles included in the citation and cocitation networks were identified from ISI Web of Knowledge which is considered as a very comprehensive collection of literature data on the web (Raghuram et al. 2010). Using ISI Web of Knowledge as a data source has been explicitly advocated for in seminal work on writing literature reviews (Webster and Watson 2002), amongst others because of the overall quality and consistency of the information as well as the forward citation data provided by the platform that allows for analyzing entire streams of research.

Software Tool Support

Two software tools were applied to build up and analyze the citation and cocitation networks. First, the software tool *CiteBridge* was designed and implemented to set up the citation network and store the information about all papers and citations in a relational database. Second, the existing software tool *Gephi* (Bastian et al. 2009) was utilized for displaying and analyzing the networks as well as for computing various network metrics.

CiteBridge is a software tool for gathering bibliographic data from scientific data repositories. The tool connects to the web service provided by ISI Web of Knowledge by using the Simple Object Access Protocol (SOAP) and implementing the underlying Application Programming Interface (API). Its flexible software architecture allows CiteBridge to connect to multiple data sources to retrieve meta information about the papers as well as information about the citations both of which as then stored in a relational database. The first method to obtain data requires specifying either a simple query string or a combination of multiple simple query strings. A query string is a search term a researcher would enter into a scientific search engine when manually searching for a paper. The second method uses a predefined publication as a root paper for the search and collects recursively all citing publications that lie within a predefined distance from the root paper.

The algorithm that is utilized to identify the data works as follows. First, the root paper itself is identified by utilizing its unique ID as a query. Consecutively, a breadth-first search algorithm is recursively executed by (a) identifying all papers citing the current paper, (b) storing these papers as new publications along with their authors and keywords, thereby adding a vertex to the citation network, (c) documenting the new citations in order to add the edges to the citation network, (d) storing the unique IDs of the papers in a list, and (e) fetching the next paper from the list as long as the predefined depth of five edges from the root paper is not exceeded. After the gathering of publication data has been completed, the citation data is stored in a relational MySQL database and can be analyzed from multiple angles. Amongst others, a citation network and a cocitation network can be generated from the data. Other opportunities comprise a co-authorship network analysis.

The conceptual model of the MySQL database in which the information is stored is depicted in Figure 1. The central table in the database is the table *Publication* which contains the meta data for all publications included in the citation network. The publications are connected to each other by *Citations*. Citatory publications are the publications citing a particular paper, whereas cited publications are the papers cited by a particular paper. All publications are authored by one or more *Authors*. Importantly, this information is stored in a separate table in the database in order to keep track of the articles that each author encountered in the analysis has co-authored. This opens up the opportunity to utilize the data

gathered for co-authorship network analysis (Fischbach et al. 2011) as well, which is possible as long as synonyms for the same person are not present in the dataset which might necessitate considerable efforts to be made before the analysis can take place (MacRoberts and MacRoberts 1989). All publications feature a set of *Keywords* that describe their content. These keywords are stored in a separate table to allow for further analysis of the papers. Finally, each publication is identified as result of a *Query* made to identify papers in the search database, such as ISI Web of Knowledge. This table documents the actual query with which each paper has been identified. The table is useful to track this information even if more than on query is executed by CiteBridge.

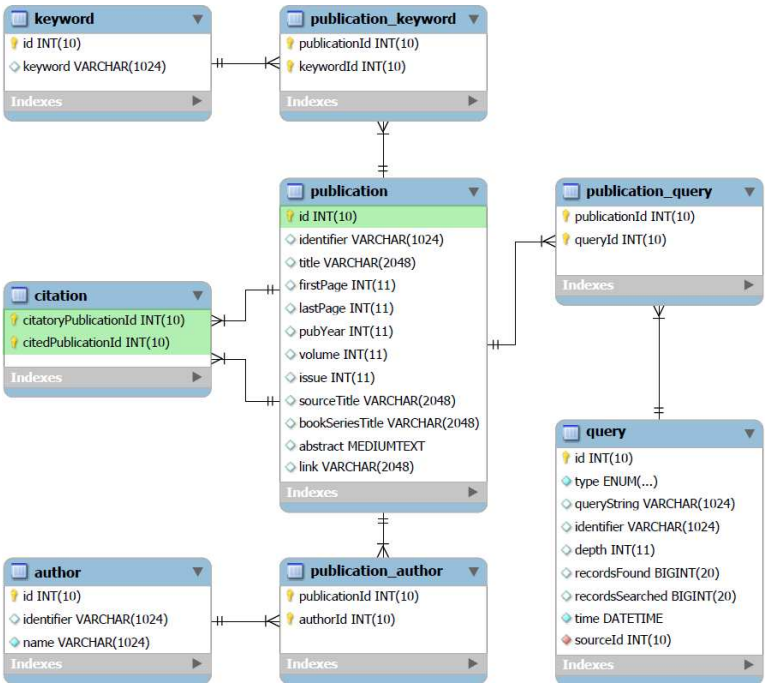


Figure 1. CiteBridge database model.

Gephi was selected as tool support to display and analyze the citation and cocitation graphs that were previously built up with the data obtained from running the CiteBridge tool. Gephi is an open source software tool that can be used to perform graph and network analysis (Bastian et al. 2009). The tool includes a 3D render engine to display large networks in real-time and includes functionality to perform various operations on network data such as spatializing, filtering, navigating, manipulating and clustering. In addition, Gephi can be easily extended with more functionality in case that predefined algorithms would not be built into the original distribution. Gephi has been used to analyze network data by other researchers (Fischbach et al. 2011).

Analysis and Results

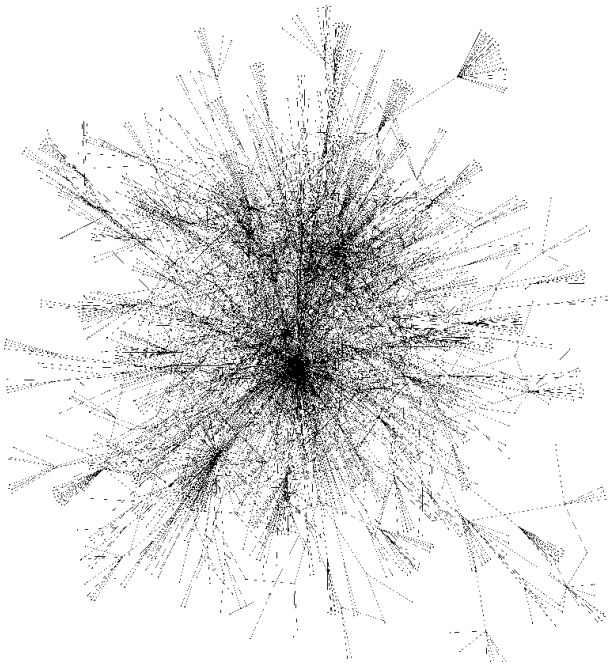
Core properties and deep structure of the SSME citation graph

In order to assess the scope and structure of the recent additions made to the service science literature, a set of key network metrics were computed for the citation network (Figure 2). The tool-based compilation of citation data from ISI Web of Knowledge yielded 3,783 papers that have a maximum distance of five citations to the S-D Logic root paper. In total, 6,775 citations were identified. The degree distribution suggests that choosing the selected root paper was appropriate since it is the paper that is cited most often (437 citations). Not surprisingly, the citation network features one connected component only, since no paper without a citation to another paper can be identified with the proposed methodology.

With respect to the degree distribution, according to the seminal book of Newman (2010), around 47% of the papers in the Science Citation Index have never been cited at all, whereas 9% have one citation, 6% have two, 21% of papers have 10 or more citations, and only 1% have 100 or more. In other words, citation networks are subject to a kind of long-tail phenomenon due to a power law degree distribution. The analysis shows that for the identified SSME citation network more than 61% of the papers have not been cited at all, whereas 15% have one citation, 7% have two, 4% have 10 or more citations, and less than 0.5% have 100 or more. In comparison with the data obtained by Newman (2010), these figures seem to indicate that many papers in the SSME literature stream have yet to be cited by other publications. In addition, there seem to be only very few "star" papers that have 100 citations or more. One interpretation could be that SSME is still an emerging field of research in which core ideas and principles are yet to be established. Another explanation could be that the papers are still too new to be referenced by many other papers, since the total number of citations a paper receives can be expected to increase with its age (Newman 2010).

Insight to RQ1: The metrics computed for the citation network that incorporates all papers within a distance of five citations from the root paper suggest that a considerably large, multi-disciplinary, and interconnected body of literature has been contributed to service science in the recent years. However, the citations are particularly unevenly distributed, resulting in few "star" papers and a large amount of papers that have not been cited in other papers at all.

Insight to RQ4: The S-D Logic root paper and its successor papers seem to form a core component of SSME research. S-D Logic appears to have diffused into many academic fields other than the service marketing field from which is originates. Therefore, there is evidence that the S-D Logic has had a strong impact on shaping the emerging SSME discipline. The apparent absence of other "star" papers suggests that SSME as a research field is still in an early stage of development and lacks a set of generally accepted core principles beyond the S-D Logic itself.



Selection of Network Metrics	Value
No. of Vertices (Papers)	3,783
No. of Edges (Citations)	6,775
Average Degree	3.509
Network Diameter	10
Average Path Length	2.055
Modularity	0.572
Number of Communities	443
Connected Components	1
Strongly Connected Components	2641
Average Clustering Coefficient	0.053
Maximum in-degree of a paper	437
Percentage of papers not cited at all	61.44%
Percentage of papers cited = 1	14.81%
Percentage of papers cited = 2	6.80%
Percentage of papers cited >= 10	3.91%
Percentage of papers cited >= 100	< 0.5%

Figure 2. Left: Layout of the complete citation graph as compiled with the CiteBridge software tool, displayed with Gephi (Yifan Hu layout). Right: Metrics of the citation graph, as computed with Gephi.

Most influential papers contained in the citation network: Authorities and Hubs

Newman (2010) outlines that there are two types of important nodes in directed networks, such as in citation networks: Authorities and Hubs. Authorities "are nodes that contain useful information on a topic of interest" (p. 179). In the context of a citation network, an authority is a paper that is cited by many other papers, and therefore has a strong influence on the further evolution of a discipline. Hubs "are nodes that tell us where the best authorities are to be found" (p.179). In the context of a citation network, this means that hubs are papers that reference the most authoritative papers, such as papers that conduct extensive literature reviews. A paper with high authority centrality is *pointed to* by many hubs, whereas a paper with a high hub centrality itself *points to* many vertices with high authority centrality. Therefore, a paper can be an authority and a hub at the same time.

Drawing from the advice by Newman (2010), the HITS algorithm (Kleinberg 1999) was applied to identify the authorities and hubs in the citation network. The authority centrality value of the paper in a citation network is computed as follows, where i denotes the number of the paper, x_i is the authority centrality of i, y_i is the hub centrality of i, and α is constant:

$$x_i = \alpha \sum_j A_{ij}\, y_i$$

The top 25 authority centrality values of the SSME citation network are reported in Table 2. Even if it is not astonishing that the root paper by far features the highest authority centrality value, since it is the oldest paper contained in the citation network, the huge gap in authority values suggests that S-D Logic indeed is a particularly prominent authority in the SSME discipline. In addition, this observation indicates that choosing the original S-D Logic as the root paper was indeed an appropriate choice for mapping the service field in the first place.

The authority centrality values suggest that many of the most authoritative papers contained in the recent body of knowledge in SSME have originated in service marketing. One explanation for this phenomenon might be that though being a paradigmatic paper whose propositions can be used in various disciplines, S-D Logic used to be focused on marketing which could lead to some degree to a lock-in effect that is reflected in the citation network. Another factor might be the publication lag (Culnan 1986) that inhibits an immediate diffusion of ideas into other disciplines. This might be one of the reasons why the IS top journal papers contributed to the service science discipline do not (yet) feature top authority values. Having been published between 2006 and 2010, their chance of being cited would not have been as good as the chances of the top authority papers, most of which were published between 2005 and 2008.

Table 2. Top 25 authorities and additional IS papers according to authority centrality, as identified from applying the HITS algorithm (in descending order).

#	Title	Journal	Reference	Auth.
1	Evolving to a new dominant logic for marketing	J. of Marketing	(Vargo and Lusch 2004)	0,0532
2	Consumer culture theory (CCT): Twenty years of research	J. of Consumer Research	(Arnould and Thompson 2005)	0,0160
3	Factors influencing the effectiveness of relationship marketing: A meta-analysis	J. of Marketing	(Palmatier et al. 2006)	0,0117
4	Corporate social responsibility, customer satisfaction, and market value	J. of Marketing	(Luo and Bhattacharya 2006)	0,0084
5	Choosing among alternative service delivery modes: An investigation of customer trial of self-service technologies	J. of Marketing	(Meuter et al. 2005)	0,0084
6	Service-dominant logic: continuing the evolution	J. of the Academy of Marketing Science	(Vargo and Lusch 2007a)	0,0081
7	A strategic framework for customer relationship management	J. of Marketing	(Payne and Frow 2005)	0,0074
8	A customer relationship management roadmap: What is known, potential pitfalls, and where to go	J. of Marketing	(Boulding et al. 2005)	0,0068
9	Competing through service: Insights from service-dominant logic	J. of Retailing	(Lusch et al. 2007)	0,0063

10	Marketing models of service and relationships	Marketing Science	(Rust and Chung 2006)	0,0061
11	Curvilinear effects of consumer loyalty determinants in relational exchanges	J. of Marketing Research	(Agustin and Singh 2005)	0,0058
12	Challenges and opportunities in multichannel customer management	J. of Service Research	(Neslin et al. 2006)	0,0056
13	A comparative longitudinal analysis of theoretical perspectives of interorganizational relationship performance	J. of Marketing	(Palmatier et al. 2007)	0,0045
14	Service portraits in service research: a critical review	Intern. J. of Services Industry Management	(Edvardsson et al. 2005)	0,0045
15	Market knowledge dimensions and cross-functional collaboration: Examining the different routes to product innovation performance	J. of Marketing	(De Luca and Atuahene-Gima 2007)	0,0044
16	Rethinking customer solutions: From product bundles to relational processes	J. of Marketing	(Tuli et al. 2007)	0,0041
17	The path to customer centricity	J. of Service Research	(Shah et al. 2006)	0,0038
18	eTransQual: A transaction process-based approach for capturing service quality in online shopping	J. of Business Research	(Bauer et al. 2006)	0,0038
19	Creating a market orientation: A longitudinal, multifirm, grounded analysis of cultural transformation	J. of Marketing	(Gebhardt et al. 2006)	0,0036
20	Customer loyalty to whom? Managing the benefits and risks of salesperson-owned loyalty	J. of Marketing Research	(Palmatier, Scheer, et al. 2007)	0,0034
21	Advancing formative measurement models	J. of Business Research	(Diamantopoulos et al. 2008)	0,0033
22	Managing the co-creation of value	J. of the Academy of Marketing Research	(Payne et al. 2007)	0,0033
23	Neglected outcomes of customer satisfaction	J. of Marketing	(Luo and Homburg 2007)	0,0033
24	Technology Acceptance Model 3 and a Research Agenda on Interventions	Decision Sciences	(Venkatesh and Bala 2008)	0,0033
25	Homo Heuristicus: Why Biased Minds Make Better Inferences	Topics in Cognitive Science	(Gigerenzer and Brighton 2009)	0,0032
....				
62	Designing web sites for customer loyalty across business domains: A multilevel analysis	JMIS	(Mithas et al. 2007)	0,0021
77	An Interdisciplinary Perspective on IT Services Management and Service Science	JMIS	(Bardhan et al. 2010)	0,0017
119	Service Science	J. of Grid Computing	(Spohrer et al. 2008)	0,0015
152	Patterns of innovation in service industries	IBM Systems J.	(Miles 2008)	0,0012

The hub centrality value of the paper in a citation network (Kleinberg 1999) is computed as follows, where i is the number of the paper, y_i is the hub centrality of i, x_j is the authority centrality of j, and β is constant:

$$y_i = \beta \sum_j A_{ji}\, x_j$$

The 27 papers with the top hub centrality values are reported in Table 3, since the papers 25 to 27 feature the same hub centrality values. Not astonishingly, the root paper itself is not contained in this list, since the publications referenced by this initial paper are not contained in the citation graph. The results show that hub papers have originated in various disciplines, such as service marketing, service management, retailing, and general business research journals. However, an emphasis on service marketing can be identified. This is not astonishing, since the citation network contains only papers that are "descendants" of the root paper. Therefore, papers situated in other disciplines which also draw from other streams of literature than the service marketing core ideas – such as IS – can be expected to have lower hub centrality values.

Table 3. Top 27 hubs and additional IS papers according to hub centrality, as identified from applying the HITS algorithm on the SSME citation network (in descending order).

#	Title	Journal	Reference	Hub
1	Consumer culture theory (CCT): Twenty years of research	J. of Consumer Research	(Arnould and Thompson 2005)	0,0120
2	Choosing among alternative service delivery modes: An investigation of customer trial of self-service technologies	J. of Marketing	(Meuter et al. 2005)	0,0080
3	Corporate social responsibility, customer satisfaction, and market value	J. of Marketing	(Luo and Bhattacharya 2006)	0,0072
4	Factors influencing the effectiveness of relationship marketing: A meta-analysis	J. of Marketing	(Palmatier et al. 2006)	0,0066
5	A customer relationship management roadmap: What is known, potential pitfalls, and where to go	J. of Marketing	(Boulding et al. 2005)	0,0056
6	Marketing models of service and relationships	Marketing Science	(Rust and Chung 2006)	0,0054
7	A strategic framework for customer relationship management	J. of Marketing	(Payne and Frow 2005)	0,0051
8	Curvilinear effects of consumer loyalty determinants in relational exchanges	J. of Marketing Research	(Agustin and Singh 2005)	0,0050
9	Challenges and opportunities in multichannel customer management	J. of Service Research	(Neslin et al. 2006)	0,0048
10	Competing through service: Insights from service-dominant logic	J. of Retailing	(Lusch et al. 2007)	0,0040
11	Service-dominant logic: continuing the evolution	J. of the Academy of Marketing Science	(Vargo and Lusch 2007a)	0,0038
12	The path to customer centricity	J. of Service Research	(Shah et al. 2006)	0,0029
13	Service portraits in service research: a critical review	Intern. J. of Service Industry Management	(Edvardsson et al. 2005)	0,0027
14	Multichannel shopping: Causes and consequences	J. of Marketing	(Venkatesan et al. 2007)	0,0026
15	Mobile Marketing: A Synthesis and Prognosis	J. of Interactive Marketing	(Shankar and Balasubramanian 2009)	0,0024
16	Rethinking customer solutions: From product bundles to relational processes	J. of Marketing	(Tuli et al. 2007)	0,0024
17	eTransQual: A transaction process-based approach for capturing service quality in online shopping	J. of Business Research	(Bauer et al. 2006)	0,0024
18	A comparative longitudinal analysis of theoretical perspectives of interorganizational relationship performance	J. of Marketing	(Palmatier, Dant, et al. 2007)	0,0024
19	Key Issues in Multichannel Customer Management: Current Knowledge and Future Directions	J. of Interactive Marketing	(Neslin and Shankar 2009)	0,0024
20	Creating a market orientation: A longitudinal, multifirm, grounded analysis of cultural transformation	J. of Marketing	(Gebhardt et al. 2006)	0,0024
21	An examination of moderator effects in the four-stage loyalty model	J. of Service Research	(Evanschitzky 2006)	0,0024
22	Advancing formative measurement models	J. of Business Research	(Diamantopoulos et al. 2008)	0,0022
23	Retailing research: Past, present, and future	J. of Retailing	(Grewal and Levy 2007)	0,0022
24	Reaping relational rewards from corporate social responsibility: The role of competitive positioning	Intern. J. of Research in Marketing	(Du et al. 2007)	0,0022
25	Host economy impacts of transnational retail: the research agenda	J. of Economic Geography	(Coe and Wrigley 2007)	0,0022
26	eWOM: The impact of customer-to-customer online know-how exchange on customer value and loyalty	J. of Business Research	(Gruen et al. 2006)	0,0022
27	Has the medium (roast) become the message? The ethics of marketing fair trade in the	Intern. Marketing Review	(Low and Davenport 2005)	0,0022

	mainstream			
...				
59	Designing web sites for customer loyalty across business domains: A multilevel analysis	JMIS	(Mithas et al. 2007)	0,0016
100	Services science	J. of Grid Computing	(Spohrer et al. 2008)	0,0011
130	Is the world flat or spiky? Information intensity, skills, and global service disaggregation	ISR	(Mithas and Whitaker 2007)	0,0009

Insight to RQ2: The most authoritative papers as well as the most essential literature review papers (in terms of their authority centrality values and hub centrality values, respectively) in the SSME discipline still seem to be focused on the traditional set of service marketing topics. Papers that have originated from other disciplines have joined into the list of the most important papers. However, they might need more time to establish themselves in the inner circle of service science papers.

Insight to RQ4: Since many of the most authoritative papers and the most essential hub papers contained in the citation network originate from the service marketing discipline, S-D Logic core papers seem to be still closely embedded into the service marketing body of knowledge. Some additional diffusion time might be required for these ideas to increase their status in other sub-disciplines of service science as well.

Clusters of research identified from a cocitation network analysis

In addition to the citation network that was utilized to answer RQ1, RQ2, and RQ4, from analyzing the data identified with CiteBridge from ISI Web of Knowledge, from this very dataset a cocitation network was constructed in order to identify clusters of research that shape the SSME discipline (RQ3) as well as add to the insights on the importance of S-D Logic (RQ4).

Two papers are cocited if they are both cited by a third paper. Each paper identified is represented as a vertex in the cocitation graph. Each cocitation identified is represented as an undirected edge between the two papers that are cocited. Since some papers are cocited by more than one paper, a weight is assigned for each cocitation, such that the cocitation graph is weighted and undirected. Since the presence of a cocitation is an indicator that two papers deal with a similar topic (Newman 2010), a cocitation analysis is based on the assumption that two papers that are cited in the same paper are likely part of the same research cluster (Garfield and Welljamsdorof 1992; Peters et al. 1995). A cocitation analysis can reveal which topics have been researched and what the interrelations of these topics are like. Therefore, cocitation networks are a good means to identify clusters of research in a particular research discipline. For instance, Raghuram et al. (2010) conduct a cocitation network analysis in the multi-disciplinary field of "virtual work" to identify clusters of research themes that have emerged over time, while Culnan (1986) analyzes the sub-fields and reference disciplines of the MIS field.

The cocitation network was set up from the data compiled in the abovementioned citation analysis. To do this, each citation contained in the citation network was compared with the other citations made to the cited papers, in order to discover the nodes of the cocitation network. For each new cocitation, a new edge was added to the cocitation network. If an edge between two papers existed already, the weight of the edge was incremented, leading to an undirected and weighted graph. From the 3,783 papers identified in the forward citation analysis, 1,094 papers (28.92 %) were found to be cocited with other papers, connected with 7,052 edges. The paper that is cocited with the most other papers is the root paper itself (295 edges).

A cocitation analysis can reveal clusters of research that have been addressed in the S-D logic research stream. In order to do this, subgraphs can be gradually selected from the original cocitation graph. For instance, Raghuram et al. (2010) initially selected only papers with more than n=15 citations and then incrementally lowered this number to 10, identifying 140 references that were at least cited n=10 times (amounting to 2% of articles in their sample).

In the first iteration of the analysis presented here, all papers that were cited less than n=10 times were excluded from the cocitation graph. This would let only the most cited papers remain in the cocitation network. The result set comprised 140 papers (12.8% of nodes in the cocitation network) and 1,311 edges (18.59%). Afterwards, the edge weight threshold in this sub-graph was incrementally increased in order to identify the strongest cocitation relationships in the network. These remaining relationships were then identified as the most popular clusters of topics that are investigated in the current service science

literature. In Table 4, the papers exceeding a threshold of 6.0 as an edge weight are reported. This result set comprises 50 nodes (4.6%) and 56 edges (7.9%), organized into seven independent clusters. Each of these clusters corresponds to one sub-graph in the cocitation network. In addition, each cluster was further investigated by grouping the papers into research topics (Table 4). The main cluster comprises classic service science topics such as the S-D Logic-related papers themselves, the transition from goods to services, service science as a research field, value co-creation and relationships, and service management. The second largest cluster encompasses multichannel issues, mobile marketing communications, and customer lifetime value. The smaller clusters comprise retailing research, customer experience management, corporate social responsibility, trademarks, and location factors. The latter topics are intriguing extensions that go beyond the traditional set of topics investigated in the traditional service literature.

Table 4. Clusters identified from a sub-graph of the cocitation network subject to an edge weight > 6.0 (50 nodes).

Clusters	Titles / Foci of Papers	Reference	#Cited
Cluster 1 (S-D Logic)	Evolving to a New Dominant Logic of Marketing (*)	(Vargo and Lusch 2004)	437
	Service-Dominant Logic: Continuing the Evolution (*)	(Vargo and Lusch 2007a)	66
	Managing the Co-Creation of Value (*)	(Payne et al. 2007)	26
	Competing through Service: Insights from Service-Dominant Logic (*)	(Lusch et al. 2007)	51
	Why "Service"? (*)	(Vargo and Lusch 2007b)	10
	From Goods to Services: Divergences and Convergences of Logics (*)	(Vargo and Lusch 2008)	22
	Toward a conceptual foundation for service science: Contributions from service-dominant logic	(Lusch et al. 2008)	13
	An expanded and strategic view of discontinuous innovations: deploying a service-dominant logic (*)	(Michel et al. 2007)	12
	Extending the service-dominant logic: from customer centricity to balanced centricity	(Gummesson 2007)	10
(From products to service)	The transition from product to service in business markets: An agenda for academic inquiry (*)	(Jacob and Ulaga 2008)	14
	Services, products, and the institutional structure of production (*)	(Araujo and Spring 2006)	19
	Rethinking customer solutions: From product bundles to relational processes (*)	(Tuli et al. 2007)	33
(Service Science)	Fundamentals of service science	(Maglio and Spohrer 2007)	11
	Service portraits in service research: a critical review (*)	(Edvardsson et al. 2005)	36
(Relationships/ Co-Creation / Exchange)	Factors influencing the effectiveness of relationship marketing: A meta analysis (*)	(Palmatier et al. 2006)	95
	Cocreating customer value through hyperreality in the prepurchase service experience	(Edvardsson 2005)	10
	A comparative longitudinal analysis of theoretical perspectives of interorganizational relationship performance	(Palmatier, Dant, et al. 2007)	36
	Consumer culture theory (CCT): Twenty years of research (*)	(Arnould and Thompson 2005)	131
	A strategic framework for customer relationship management (*)	(Payne and Frow 2005)	60
	A customer relationship management roadmap: What is known, potential pitfalls, and where to go (*)	(Boulding et al. 2005)	55
	Marketing as service-exchange: Taking a leadership role in global marketing management (*)	(Lusch et al. 2006)	15
	Choosing among alternative service delivery modes: An investigation of customer trial of self-service technologies (*)	(Meuter et al. 2005)	68
	Co-production and customer loyalty in financial services	(Auh et al. 2007)	17
(Service Management)	Branding in B2B markets: insights from the service-dominant logic of marketing	(Ballantyne and Aitken 2007)	11
	Improving firm positioning through enhanced offerings and buyer-seller relationships	(Penttinen and Palmer 2007)	14
	Role of competences in creating customer value: A value-creation logic approach	(Moller 2006)	22
	Six strategies for competing through service: An agenda for future	(Bolton et al. 2007)	11

	research		
	The path to customer centricity	(Shah et al. 2006)	30
Cluster 2 (Multi-channel)	Multichannel customer management: Understanding the research-shopper phenomenon (*)	(Verhoef et al. 2007)	17
	Multichannel shopping: Causes and consequences (*)	(Venkatesan et al. 2007)	17
	Challenges and opportunities in multichannel customer management (*)	(Neslin et al. 2006)	45
	Key Issues in Multichannel Customer Management: Current Knowledge and Future Directions (*)	(Neslin and Shankar 2009)	24
(Mobile Marketing / Communi-cation)	Mobile Marketing in the Retailing Environment: Current Insights and Future Research Avenues	(Shankar et al. 2010)	10
	Flow Online: Lessons Learned and Future Prospects (*)	(Hoffman and Novak 2009)	17
	Interactive Services: A Framework, Synthesis and Research Directions	(Bolton and Saxena-Iyer 2009)	17
	Online Trust: State of the Art, New Frontiers, and Research Potential	(Urban et al. 2009)	13
	Mobile Marketing: A Synthesis and Prognosis (*)	(Shankar and Balasubramanian 2009)	20
	New Communications Approaches in Marketing: Issues and Research Directions (*)	(Winer 2009)	12
(Customer Lifetime Value)	Customer-Based Valuation	(Gupta 2009)	10
	Customer Lifetime Value: Empirical Generalizations and Some Conceptual Questions	(Blattberg et al. 2009)	10
Cluster 3 Retailing Research	Scientific Method and Retailing Research – A Retrospective	(Brown and Dant 2008)	16
	Retailing Research – Past, Present, and Future	(Grewal and Levy 2007)	21
Cluster 4 Customer Experience	Customer Experience Management in Retailing – Understanding the buying process	(Puccinelli et al. 2009)	14
	Customer Experience Creation – Determinants, Dynamics and Management Strategies	(Verhoef et al. 2009)	13
Cluster 5 Corporate Social Res-ponsibility	Corporate Social Responsibility, Customer Satisfaction, and Market Value	(Luo and Bhattacharya 2006)	68
	Reaping Relational Rents from Corporate Social Responsibility: The Role of Competitive Positioning	(Du et al. 2007)	20
Cluster 6 Trademarks	Rethinking Trademark Fair Use	(McGeveran 2008)	12
	Gone in sixty milliseconds: Trademark law and cognitive science	(Tushnet 2008)	12
Cluster 7 Location Factors	Scoping and conceptualising retailer internationalisation	(Dawson 2007)	11
	Host economy impacts of transnational retail: the research agenda	(Coe and Wrigley 2007)	21

In the second iteration, all papers with an edge weight not exceeding a threshold of 8.0 were removed from the cocitation graph, arriving at a set of 24 papers (2.19%) and 26 edges (0.37%). The papers contained in this result set are marked with an asterisk (*) in Table 4. As can be seen, all clusters apart from the two larger clusters have been blended out on this level of detail. Figure 3 displays the corresponding cocitation graph in which several topics can be identified on close inspection. As can be seen, only two clusters of papers can be found in this result set. The larger cluster is a subset of the papers related to the S-D Logic core topics, whereas the smaller cluster is focused on multichannel issues as well as on mobile marketing and communications.

Insight to RQ3: Consistent with the observation that the most influential papers in the S-D Logic research stream still are to be found in the service marketing discipline, most of the research clusters identified with the cocitation network analysis have strong relations to service marketing core topics such as multichannel management, mobile marketing, or customer experience management. However, IS-related topics such as self-service technologies and Customer Relationship Management (CRM) also constitute cornerstones in the SSME research agenda.

Insight to RQ4: As can be inferred from the properties of Cluster 1, the S-D Logic core ideas have been cocited frequently with other papers, such that the S-D Logic cluster is the largest one on both analyzed levels of detail. Therefore, it can be inferred that S-D Logic can be regarded as a central topic in the emerging service science discipline that binds together other research ideas – subject to the properties of the analyzed dataset that emphasized the S-D Logic research stream itself.

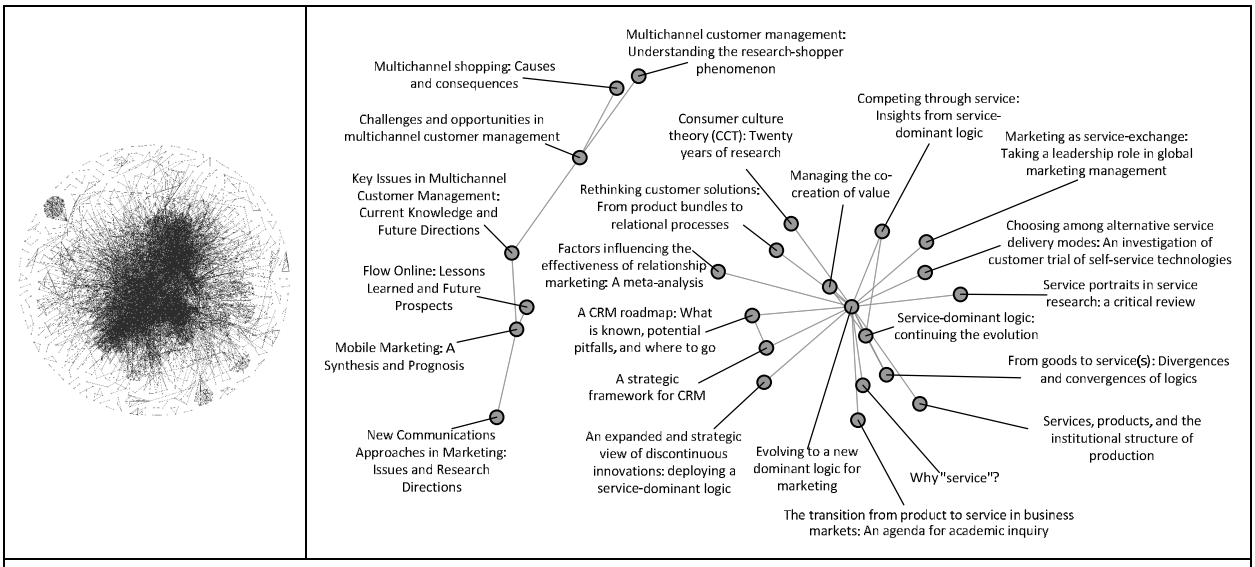


Figure 3. Left: Overview of the entire cocitation network (1,094 nodes and 7,052 edges). Right: Clusters identified from a sub-graph of the cocitation network subject to an edge weight > 8.0 (24 nodes and 26 edges).

Discussion

Contributions and limitations of the study

From a theory point of view, the results of this study contribute new insights on the state and evolution of SSME that is much needed as a point of reference to help researchers find their way into this multi-facetted and emerging research discipline. In addition, the conceptual design of the software tool CiteBridge was presented. The tool successfully gathered citation data from ISI Web of Knowledge that would have been impossible to obtain without software support. As a consequence, it is argued that the results presented in this study do not suffer from a focus on a few top journals, a geographic region, a pre-defined research methodology, or a certain sub-discipline, which have been found to be common shortcomings of many literature review articles (Webster and Watson 2002). Instead, due to gathering the data with a software tool, the course of the literature review was entirely driven by the citation data itself and was not influenced by any interpretations, leading to an objective (Culnan 1986) and (virtually) complete census of relevant literature (Raghuram et al. 2010). The advantage of performing the described citation and cocitation analysis lies in generating understanding of a field and its dynamics (Braam et al. 1991). On the other hand, the broad conceptualization inherent in bibliometric studies cannot provide an in-depth understanding of a field that traditional reviews can generate (Raghuram et al. 2010). Therefore, the results presented are intended as a first mapping of the field that needs to be verified and extended by further research.

The diversity of research disciplines from which the papers contained in the citation and cocitation networks have originated suggests that an interdisciplinary service science community is forming around the core paradigms posited by the Service-Dominant Logic of Marketing as the (by far) most frequently cited paper in the network. A limitation to this result might be preferential attachment which is a well-known effect in citation networks. It denotes that papers that have been cited often do have a greater chance of being cited again (Newman 2010). In the case of S-D Logic this could mean that the high degree the papers have in the citation network does only partially result from the quality of its contributions itself; other citations might result from a kind of bandwagon effect caused by researchers feeling 'forced' to cite the papers in order to get their own research accepted for publication. Since such analyses are beyond the scope of this paper, it is left to future research to identify whether the preferential attachment effect is present at all.

The analysis of the top authorities and hubs in the citation network suggests that the inner core of papers is still dominated by the classic research agendas of the service marketing and service management disciplines, whereas insights from other disciplines such as IS, computer science, or operations research seem to have only partially joined into the inner circle of the service science research stream. One possible explanation is that – given that the root paper is itself strongly connected to previous research in service marketing – papers originating from other reference disciplines might require more time to be cited from outside their own disciplines. Another interpretation could be that the paradigms stated by S-D Logic have their greatest validity inside the service marketing sub-community in SSME. In addition, the citing behavior in different disciplines participating in SSME could differ. For instance, service marketing scholars might refer to the core research ideas published in service marketing top journals more than IS researchers stick to IS top journal papers, because they tend to also include citations to conference papers or web resources, such as to cite work on web services or other internet-based technologies.

In addition, an obvious limitation is the compilation of the citation data itself. Although more papers and citations about service science were compiled that in any of the discussed literature reviews before, only papers that are associated with the root paper within a maximum distance of five citations could be included into the dataset. Therefore, the dataset investigated can by no means cover all facets of the multi-disciplinary field of SSME. In addition, even carefully managed high quality data repositories such as ISI Web of Knowledge might suffer from not including many crucial papers that are published online, in conference proceedings, or preprint archives (Goodrum 2001). Since these publication practices are more common in computer science and the engineering disciplines than in the social sciences, the results presented might overemphasize the importance of the social sciences. To address these biases, future literature analyses can be performed to compare the results with citation data compiled from other data sources (Meho and Yang 2007).

With the cocitation analysis, a boundary map of characteristic research clusters in the discipline has been created to display the current focus of the discipline to enable other researchers to draw their own conclusions (Raghuram et al. 2010). In the cocitation network there also seems to be a focus set on traditional service marketing topics such as multichannel retailing, customer lifetime value, relationship management, customer integration, or service experience. This suggests that the service marketing discipline is still ahead of other sub-disciplines of SSME research in terms of citations. Given the comparatively small time horizon of the analysis, the cocitation network that was built up in this paper seems to indicate a rather lively and closely interconnected body of knowledge. In their analysis, Raghuram et al. (2010) identified 490 articles while the analysis reported here comprises 1,094 articles in a period of only 7 years (2004-2011). This observation is intriguing since the literature investigated in this paper has all been published within a comparably small period of time, which can be assumed to be a disadvantage in terms of receiving citations from other papers, since the chance that a paper will be cited increases with its age (Newman 2010). Another limitation is that no clustering algorithm has been applied to identify the clusters of research from the cocitation graph. Raghuram et al. (2010) apply the Jaccard index (Small and Greenlee 1980) to do this. The data compiled for this study allows for applying this algorithm. However, it is not yet part of the Gephi tool and, therefore, would need to be added to the tool before the analysis can be performed.

From a management point of view, the insights reported here can be valuable as a point of reference to make research results accessible for the daily business in service firms. Managers might be able to identify core papers and research clusters more easily which might help to increase the diffusion of research results into practical application.

Outlook

Since one crucial element of a literature review paper is to provide guidance for further research, six directions are outlined in which the results can be further advanced in future SSME research.

First, the top authority and hub papers identified in this study can be reviewed and coded in an in-depth fashion to build new theory in the young SSME discipline. For instance, a concept matrix (Webster and Watson 2002) can be applied to assess how crucial service science concepts are used in the papers in order to consolidate or build new theory. Although this is a promising research vista, it has not been in the focus of this study. The intention was rather to provide the SSME community with a rigorously derived set

of papers that the research community can used to justify their own selection of papers when coding them with theoretical constructs. One suitable coding schema could include the foundational premises of S-D Logic and assess how they are applied, extended, or criticized in the papers.

Second, the research clusters identified in the cocitation analysis can be systematized into a conceptual framework to map the most popular research topics and provide directions for future research. A first interpretation can be provided by grouping the topics around the roles of the service firm and the customer, mediated by a dyadic relationship that indicates co-production (Vargo et al. 2010). In this topology, the identified clusters of research apparently focus on the service firm itself and the interaction with the customer, but neglect research on how customers do or need to behave in the process of co-production. This research gap becomes even more pressing in the B2B sector, where customers are companies rather than consumers, who need to design their work practices, business processes, and information systems to make these interactions more efficient. Therefore, future research could spend more effort on theorizing on the nature of B2B interactions in a service context, as well as design innovative IT artifacts in accordance with these theories.

Third, the study described in this paper can easily be replicated with other root papers than the S-D Logic paper selected here. This is expected to shed more light on other research streams in the multi-facetted SSME discipline and increase our understanding of the nature of the discipline. A crucial point to keep in mind here, however, is that the citation network will grow exponentially with each layer added to the analysis. Adding insights from analyses with different root papers, such as from computer science or IS backgrounds, could also help to identify structural holes (Burt 1995) in the discipline. Bridging these structural holes can be expected to yield great value for bringing together disparate research streams in a field as heterogeneous as SSME and lead to a shared identity in the discipline.

Fourth, cocitation network data can be used for longitudinal analyses on the evolution of a research discipline as performed by Raghuram et al. (2010) for the field of virtual work. Although all data for performing this analysis have been obtained and stored in the database, this was beyond the scope of this paper. Such an analysis could provide the research community with results on the emergence and proliferation of topics in the service science discipline which would be valuable to trace its evolution over time.

Fifth, Webster and Watson (2002) state that a literature review shall start with an appropriate selection of journal publications and then perform a backward as well as a forward search. In this paper, a forward citation analysis was performed by analyzing the research stream that originated from the S-D Logic core paper. However, performing an intensive backward search has to be left to future research, since ISI Web of Knowledge seems not provide sufficient functionality to automatically build up the citation graph in this direction. Still, such an analysis could provide deeper insights into where the core topics of the service science literature originated and what evolution they were subjected to.

Sixth, the results identified in this study can be matched with the topics currently discussed on service science conferences in order to cross-check the results and to identify prospects for shaping the future course of the discipline. This could add some of the currently debated 'hot' service science topic to the list of issues investigated, since the most frequently cited papers deal with rather well established topics that have been around long enough to assume central positions in the citation network.

Acknowledgements

The research reported in this paper is sponsored by the German Federal Ministry of Education and Research (BMBF) in the context of the research project "Networked Service Society", promotion sign APR 10/805. In addition, I gratefully acknowledge the work of Dominik Lekse on designing the CiteBridge software tool and for his helpful assistance with preparing the data for analysis.

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